

UNIVERSITE DE PARIS
UFR MATHÉMATIQUES ET INFORMATIQUE

Rapport sur les Ateliers Pratiques Google Cloud

Master 1 Vision Machine Intelligente

Merve ERBAS

Encadré par Benoit CHARROUX

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1. Introduction

Ce rapport présente une révision des ateliers pratiques que j'ai suivis sur Google Cloud. Ces ateliers m'ont permis d'acquérir des compétences pratiques en utilisant divers services et outils de Google Cloud Platform (GCP). Chaque étape de l'atelier sera détaillée avec les objectifs, les actions entreprises et les résultats obtenus.

2. Objectifs des Ateliers

Les principaux objectifs des ateliers étaient :

- Comprendre les principes de base de Google Cloud Platform.
- Apprendre à déployer des applications sur GCP.
- Utiliser des services spécifiques de GCP.
- Apprendre à configurer et à sécuriser les services cloud.
- Analyser des données en utilisant les outils de Google Cloud.

Les ateliers suivis incluait :

1. Introduction à Google Cloud Platform
2. Développement d'applications : déployer l'application dans Kubernetes Engine – Python
3. Infrastructure as Code avec Terraform

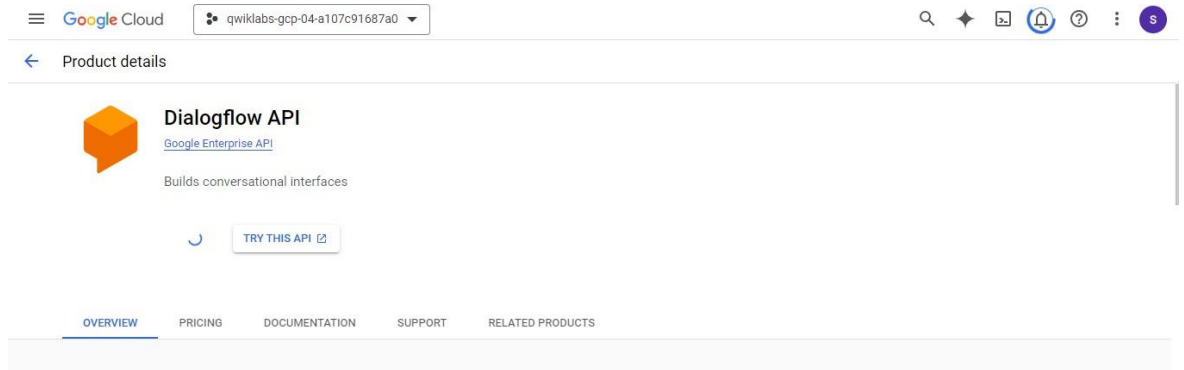
3. Etapes et Résultats

Étape 1 : Présentation des ateliers pratiques Google Cloud

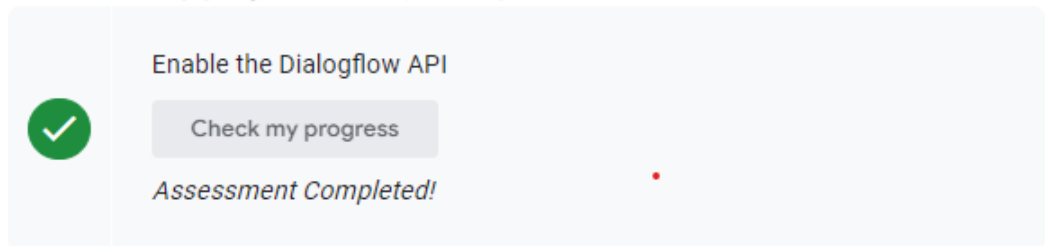
Se familiariser avec l'interface de Google Cloud Console et comprendre les concepts de base.

Actions :

- Accéder à la console Cloud
- Les projets dans la console Cloud
- Rôles et autorisations.
- API et services

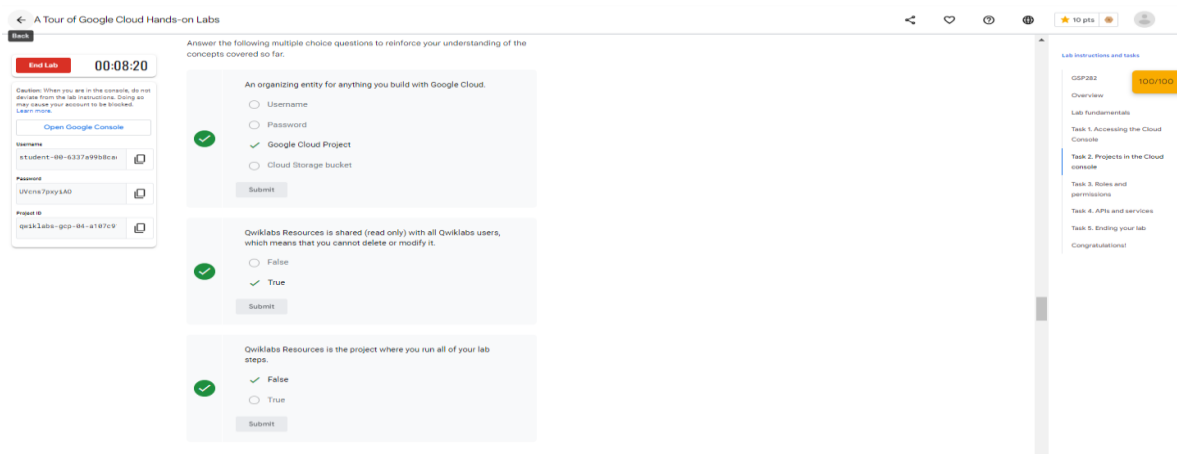


Click **Check my progress** to verify the objective.



If you're interested in learning more about APIs, refer to the [Google APIs Explorer Directory](#). The lab, [APIs Explorer: Qwik Start](#), also provides hands-on experience with the tool, using a simple example including traffic levels, error rates, and even latencies, which helps you quickly triage problems with applications that use Google services.

-Terminer l'atelier



Étape 2 : Développement d'applications : déployer l'application dans Kubernetes Engine – Python

Google Kubernetes Engine (GKE) est un service géré qui permet de déployer, gérer et faire évoluer des applications conteneurisées à l'aide de l'infrastructure Google. GKE utilise des clusters de machines virtuelles pour exécuter des conteneurs orchestrés par Kubernetes, offrant des fonctionnalités telles que la gestion automatique des pods, la mise à l'échelle automatique et la mise à jour continue.

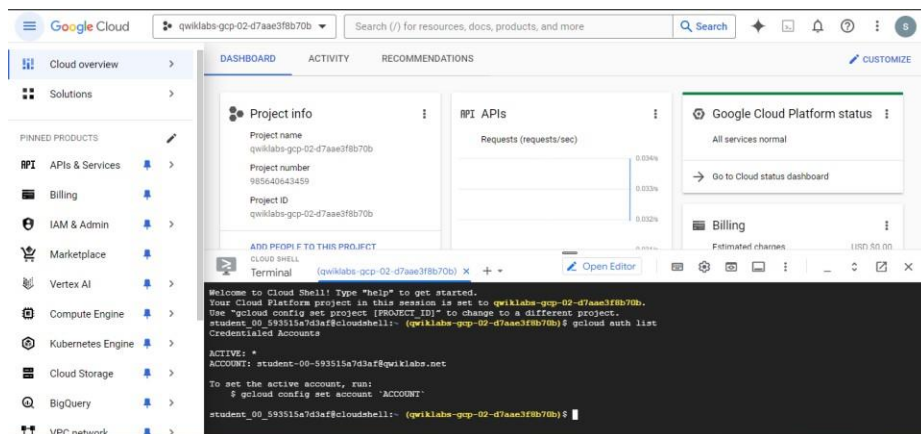
Dans cet atelier, nous avons déployé l'application Quiz dans Kubernetes Engine. Nous avons utilisé les services de Google Cloud Platform, tels que Container Builder (maintenant Cloud Build) et Container Registry, ainsi que les ressources Kubernetes comme les déploiements, les pods et les services.

Objectifs :

- Les objectifs de cet atelier étaient les suivants :
- Créer des Dockerfiles pour le frontend et le backend de l'application Quiz.
- Utiliser Cloud Build pour générer des images Docker.
- Provisionner un cluster GKE pour héberger l'application Quiz.
- Utiliser des déploiements Kubernetes pour provisionner des pods répliqués.
- Configurer un service Kubernetes pour créer un équilibreur de charge pour le frontend de l'application.

Actions :

1) Activer Cloud Shell



2) Préparer l'application Quiz

Modifiez le répertoire de travail :

`cd ~/kubernetesengine/start`

`. prepare_environment.sh`

```

Downloading certifi-2024.2.2-py3-none-any.whl (163 kB)
 163.8/163.8 KB 12.0 MB/s eta 0:00:00
Downloading charset_normalizer-3.3.2-cp310-cp310-manylinux_2_17_x86_64.manylinux2014_x86_64.whl (142 kB)
 142.1/142.1 KB 12.0 MB/s eta 0:00:00
Downloading googleapis_common_protos-1.63.0-py3-none-any.whl (229 kB)
 229.1/229.1 KB 12.0 MB/s eta 0:00:00
Downloading idna-3.7-py3-none-any.whl (66 kB)
 66.8/66.8 KB 12.0 MB/s eta 0:00:00
Downloading MarkupSafe-2.1.5-cp310-cp310-manylinux_2_17_x86_64.manylinux2014_x86_64.whl (25 kB)
 25.3/25.3 KB 12.0 MB/s eta 0:00:00
Installing collected packages: google-cloud, urllib3, sqlparse, pyasn1, protobuf, MarkupSafe, itsdangerous, idna, grpcio, google-crc32c, click, charset-normalizer, certifi, cachetools, blinker, Werkzeug, rsa, requests, pyasn1-modules, proto-plus, Jinja2, grpcio-tools, grpcio-gcp, grpc-interceptor, googleapis-common-protos, google-resumable-media, grpcio-status, google-auth, Flask, grpc-google-iam-v1, google-api-core, google-cloud-core, google-cloud-storage, google-cloud-spanner, google-cloud-pubsub, google-cloud-language, google-cloud-datastore
Successfully installed Flask-3.0.3 Jinja2-3.1.4 MarkupSafe-2.1.5 Werkzeug-3.0.3 blinker-1.8.2 cachetools-5.3.3 certifi-2024.2.2 charset-normalizer-3.3.2 click-8.1.7 google-api-core-2.19.0 google-auth-2.29.0 google-cloud-0.34.0 google-cloud-core-2.4.1 google-cloud-datastore-2.19.0 google-cloud-language-2.13.3 google-cloud-pubsub-2.21.1 google-cloud-spanner-3.46.0 google-cloud-storage-2.16.0 google-crc32c-1.5.0 google-resumable-media-2.7.0 googleapis-common-protos-1.63.0 grpc-google-iam-v1-0.13.0 grpc-interceptor-0.15.4 grpcio-1.63.0 grpcio-gcp-0.2.2 grpcio-status-1.62.2 grpcio-tools-1.62.2 idna-3.7 itsdangerous-2.2.0 proto-plus-1.23.0 protobuf-4.25.3 pyasn1-0.6.0 pyasn1-modules-0.4.0 requests-2.31.0 rsa-4.9.0 sqlparse-0.5.0 urllib3-1.26.18
Creating Datastore entities
Export credentials key.json
Creating Cloud Pub/Sub topic
Created topic [projects/qwklabs-gcp-02-d7aae3f8b70b/topics/feedback].
Created subscription [projects/qwklabs-gcp-02-d7aae3f8b70b/subscriptions/worker-subscription].
Creating Cloud Spanner Instance, Database, and Table
Creating instance...done.
Creating database...done.
Project ID: qwklabs-gcp-02-d7aae3f8b70b
(developingapps) student_00_593515a7d3af@cloudshell:~/kubernetesengine/start (qwklabs-gcp-02-d7aae3f8b70b) $

```

← App Dev: Deploying the Application into Kubernetes Engine - Python

End Lab 00:35:07

Caution: When you are in the console, do not deviate from the lab instructions. Doing so may cause your account to be blocked. Learn more.

Open Google Cloud console

Username: student-00-593515a7d3a

Password: H2Y1tqj9661

Project ID: qwiklabs-gcp-00-d78ae3

prepare_environment.sh

This script file:

- Creates a Google App Engine application.
- Exports environment variables GCPLOUD_PROJECT and GCPLOUD_BUCKET.
- Updates pip then runs `pip install -r requirements.txt`.
- Creates entities in Google Cloud Datastore.
- Creates a Google Cloud Pub/Sub topic.
- Creates a Cloud Spanner Instance, Database, and Table.
- Prints out the Project ID.

The Quiz application is configured when you see the following message:

Example output message

```

Creating Cloud Pub/Sub topic
Created topic [projects/qwiklabs-gcp-92b7e5716e8cb7e/topics/feedback].
Created subscription [projects/qwiklabs-gcp-92b7e5716e8cb7e/subscriptions/worker-subscription].
Creating Cloud Spanner Instance, Database, and Table
Creating instance...done.
Creating database...done.
Project ID: qwiklabs-gcp-92b7e5716e8cb7e
  
```

Click Check my progress to verify the objective.

Configure the Quiz application

Check my progress

Assessment Completed!

Lab Instructions and tasks

GSP188 Overview 0/100

What you'll learn

Setup and requirements

Prepare the Quiz application

Review the code

Create and connect to a Kubernetes Engine Cluster

Build Docker images using Container Builder

Create Kubernetes deployment and service resources

Test the Quiz Application

Congratulations!

-Créer un cluster Kubernetes Engine et s'y connecter

← App Dev: Deploying the Application into Kubernetes Engine - Python

End Lab 00:40:49

Caution: When you are in the console, do not deviate from the lab instructions. Doing so may cause your account to be blocked. Learn more.

Open Google Cloud console

Username: student-00-c5fd7272d7a2

Password: F1XXK11U2CR3

Project ID: qwiklabs-gcp-00-d98b58fad461

Create a Kubernetes Engine cluster

- In the Cloud Platform Console, click **Navigation menu** (☰) > **Kubernetes Engine** > **Clusters**.
- Click **Create**.
- Click **Switch to the Standard cluster** on the top right corner. Set the following fields to the provided values, leave all others at the default value:

Property	Value
Name	quiz-cluster
Zone	us-central1-c
default Pool > Security > Access scopes	Select Allow full access to all Cloud APIs
- Click **Create**. The cluster takes a few minutes to provision.

Click Check my progress to verify the objective.

Create Kubernetes engine cluster

Check my progress

Assessment Completed!

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merve.eras@etu.un-paris.fr
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Create Kubernetes deployment and service resources

Test the Quiz Application

Congratulations!

-Connect to the cluster

kubectl get pods

```

or to unset it, run:

$ gcloud config unset project
student_00_c5fd7272d7a2@cloudshell:~ (quiklabs-gcp-00-d98b58fad461) $ gcloud container clusters get-credentials quiz-cluster --zone us-central1
--project qwiklabs-gcp-00-d98b58fad461
Fetching cluster endpoint and auth data.
kubeconfig entry generated for quiz-cluster.
student_00_c5fd7272d7a2@cloudshell:~ (quiklabs-gcp-00-d98b58fad461) $ kubectl get pods
No resources found in default namespace.
student_00_c5fd7272d7a2@cloudshell:~ (quiklabs-gcp-00-d98b58fad461) $
  
```


- Créer des images Docker avec Container Builder

Dans l'éditeur de code Cloud Shell, ouvrez `frontend/Dockerfile`. Vous allez ensuite ajouter un bloc de code qui exécute les actions suivantes :

- Saisie de la commande Dockerfile pour initialiser la création d'une image Docker personnalisée avec, pour point de départ, l'image Python App Engine de Google
- Codage des commandes Dockerfile pour activer un environnement virtuel
- Codage de la commande Dockerfile pour exécuter `pip install` dans le cadre du processus de création
- Codage de la commande Dockerfile pour ajouter les contenus du dossier actuel au chemin `/app` dans le conteneur
- Création du Dockerfile à l'aide de l'instruction `gunicorn...` qui s'exécute lorsque le conteneur est ouvert. Gunicorn (Green Unicorn) est un serveur HTTP compatible avec la spécification de l'interface passerelle de serveur Web (WSGI) Python.

On copie ensuite le code suivant et colles dans le fichier `Dockerfile` :

```
FROM gcr.io/google_appengine/python
```

```
RUN virtualenv -p python3.7 /env
```

```
ENV VIRTUAL_ENV /env
```

```
ENV PATH /env/bin:$PATH
```

```
ADD requirements.txt /app/requirements.txt
```

```
RUN pip install -r /app/requirements.txt
```

```
ADD . /app
```

```
CMD gunicorn -b 0.0.0.0:$PORT quiz:app
```

On ouvre ensuite le fichier `backend/Dockerfile`, puis copiez et collez le code suivant :

```
FROM gcr.io/google_appengine/python
```

```
RUN virtualenv -p python3.7 /env
```

```
ENV VIRTUAL_ENV /env
```

```
ENV PATH /env/bin:$PATH
```

```
ADD requirements.txt /app/requirements.txt
```

```
RUN pip install -r /app/requirements.txt
```

```
ADD . /app
```

```
CMD python -m quiz.console.worker
```

- On exécute la commande suivante pour créer l'image Docker frontale:

```
gcloud builds submit -t gcr.io/$DEVSHHELL_PROJECT_ID/quiz-frontend  
./frontend/
```

et pour créer l'image Docker du backend :

```
gcloud builds submit -t gcr.io/$DEVSHHELL_PROJECT_ID/quiz-backend ./backend/
```

Lorsque l'image Docker du backend est prête :

```
CLOUD SHELL
Terminal (qwiklabs-gcp-00-d98b58fad461) x + v Open Editor

16919ab89eca: Waiting
74bcef7f7402: Waiting
bc9e931c388e: Waiting
20896f2c3dd8: Waiting
7b80c69caf34: Waiting
087d7553d285: Layer already exists
16919ab89eca: Layer already exists
74bcef7f7402: Layer already exists
bc9e931c388e: Layer already exists
20896f2c3dd8: Layer already exists
7b80c69caf34: Layer already exists
3bbec54fac0c: Layer already exists
0d75bf009989: Pushed
52844cfe00ea: Pushed
4006ffa4c683: Layer already exists
84ff92691f90: Layer already exists
844d958e8cbe: Layer already exists
dcb7197db903: Layer already exists
b49bce339f97: Layer already exists
0698011c0ba2: Pushed
c8b0957b678f: Pushed
latest: digest: sha256:3ad31c5c84d0070b7bb0edc044e8ad3a7eb6528c1da7ed1329ca2e60ab6521e8 size: 3672
DONE

-----
ID: 07e5f98c-4f78-43ad-bf93-f6fc24e799b3
CREATE_TIME: 2024-05-18T22:18:44+00:00
DURATION: 2M47S
SOURCE: gs://qwiklabs-gcp-00-d98b58fad461_cloudbuild/source/1716070723.986887-10981a7d47f44bb7b90254d6721952d6.tgz
IMAGES: gcr.io/qwiklabs-gcp-00-d98b58fad461/quiz-backend (+1 more)
STATUS: SUCCESS
(developingapps) student_00_c5fd7272d7a2@cloudshell:~/kubernetesengine/start (qwiklabs-gcp-00-d98b58fad461) $
```

On peut voir les deux pods suivants : `quiz-frontend` et `quiz-backend` sur **Container Registry**.

Google Cloud qwiklabs-gcp-00-d98b58fad461 conta Search

Container Registry Repositories

Images Settings

Upgrade to Artifact Registry

Container Registry is deprecated and scheduled for shutdown. After May 15, 2024, Artifact Registry will host images for the gcr.io domain by default in projects without previous Container Registry usage. After March 18, 2025, Container Registry will be shut down. To learn more about your options to upgrade to Artifact Registry, see [Prepare for Container Registry shutdown](#).

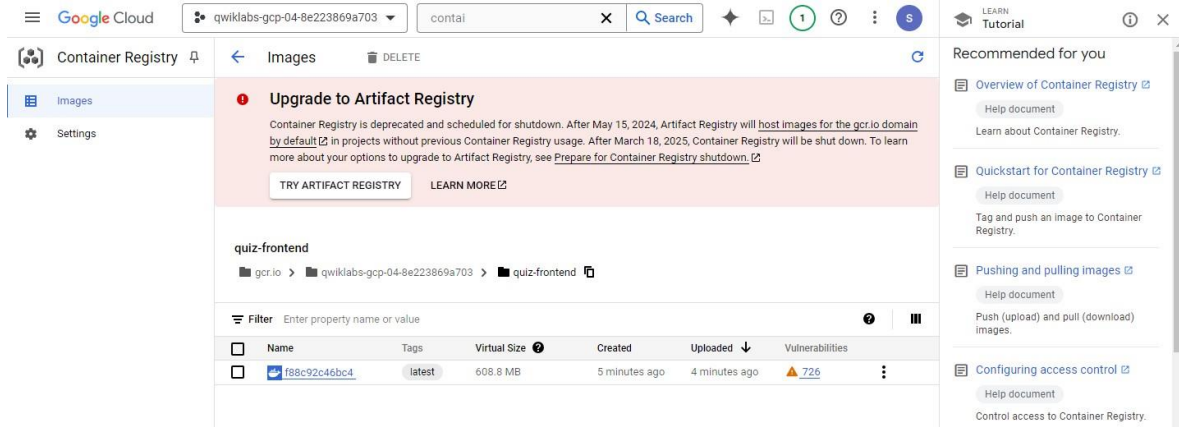
TRY ARTIFACT REGISTRY LEARN MORE

qwiklabs-gcp-00-d98b58fad461

Filter Enter property name or value

Name	Hostname	Visibility
quiz-backend	gcr.io	Private
quiz-frontend	gcr.io	Private

On clique sur **quiz-frontend** :



Et j'ai complété cet étapes aussi :



- Créer des ressources de déploiement et de service Kubernetes

Dans Cloud Shell, provisionnez le déploiement de l'interface de Quiz.

```
kubectl create -f./frontend-deployment.yaml
```

Provisionnez le déploiement du backend de Quiz.

```
kubectl create -f./backend-deployment.yaml
```

Provisionnez le service de l'interface de Quiz.

```
kubectl create -f./frontend-service.yaml
```

←

Développement d'applications : déployer l'application dans Kubernetes Engine – Python

★ 220 pts

🕒 24th

Terminer

Fatier

00:07:55

Attention : Une fois dans la console, respectez scrupuleusement les instructions de l'atelier. À défaut, votre compte pourrait être bloqué. En savoir plus.

Open Google Cloud console

Username

student-00-8906b0eedfb

Password

m1r1UY0ciheA

Project ID

qwiklabs-gcp-04-8e223869a703

2. Provisionnez le déploiement du backend de Quiz.

kubectl create -f ./backend-deployment.yaml

3. Provisionnez le service de l'interface de Quiz.

kubectl create -f ./frontend-service.yaml

Chaque commande provisionne des ressources dans Kubernetes Engine. Ce processus dure quelques minutes.

Cliquez sur Vérifier ma progression pour vérifier l'objectif.

✓

Créer des ressources de déploiement et de service Kubernetes

Vérifier ma progression

Assessment Completed!

Merve Erbas

merve.eras@etu.u-paris.fr

Essai de 30 jours

Paramètres

Se déconnecter

Vie privée · Conditions d'utilisation

Créer des Images Docker avec Container Builder

-Tester l'application Quiz

Google Cloud

qwiklabs-gcp-04-8e223869a703

contai

Q Search

1

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S

LEARN Tutorial

Kubernetes Engine

Deployment d...

REFRESH

EDIT

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OPERATIONS

Learn about Enterprise

All Fleets

Resource Management

Overview

Clusters

Workloads

Teams NEW

Applications

Secrets & ConfigMaps

Storage

Object Browser

Backup for GKE

Marketplace

Release Notes

Pod specification

Revision 1, containers: quiz-frontend

Horizontal Pod Autoscaler

Not configured

Vertical Pod Autoscaler

Not configured

Active revisions

Revision	Name	Status	Summary	Created on	Pods running/Pods total
1	quiz-frontend-764cd7844f	OK	quiz-frontend: gcr.io/qwiklabs-gcp-04-8e223869a703/quiz-frontend	May 19, 2024, 4:59:01 PM	3/3

Managed pods

Revision	Name	Status	Restarts	Created on
1	quiz-frontend-764cd7844f-w7vj	Running	0	May 19, 2024, 4:59:01 PM
1	quiz-frontend-764cd7844f-dcw8	Running	0	May 19, 2024, 4:59:01 PM
1	quiz-frontend-764cd7844f-6wwsb	Running	0	May 19, 2024, 4:59:01 PM

Exposing services

Name	Type	Endpoints
quiz-frontend	Load balancer	35.184.52.72:80

Recommended for you

Deploying workloads

Deploy a stateful application

Deploy a stateless Windows application

Expose applications using services

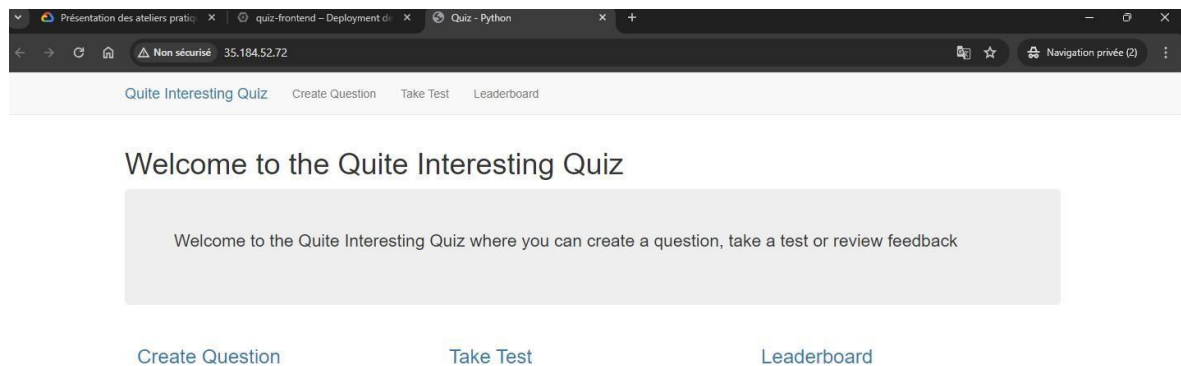
GKE Ingress

Cloud Shell

Terminal

(qwiklabs-gcp-04-8e223869a703)

Open Editor



Étape 2 : Infrastructure as Code avec Terraform

- Vérifier l'installation de Terraform et ajouter un fournisseur Google Cloud

```
CLOUD SHELL
Terminal (qwiklabs-gcp-01-0824af387e69) X + ▾ Open Editor

Welcome to Cloud Shell! Type "help" to get started.
Your Cloud Platform project in this session is set to qwiklabs-gcp-01-0824af387e69.
Use "gcloud config set project [PROJECT_ID]" to change to a different project.
student_00_d3f3d85fa4728@cloudshell:~ (qwiklabs-gcp-01-0824af387e69) $ terraform --version
Terraform v1.5.7
on linux_amd64

Your version of Terraform is out of date! The latest version
is 1.8.3. You can update by downloading from https://www.terraform.io/downloads.html
student_00_d3f3d85fa4728@cloudshell:~ (qwiklabs-gcp-01-0824af387e69) $ mkdir compute
student_00_d3f3d85fa4728@cloudshell:~ (qwiklabs-gcp-01-0824af387e69) $ touch main.tf
student_00_d3f3d85fa4728@cloudshell:~ (qwiklabs-gcp-01-0824af387e69) $ terraform init

Initializing the backend...

Initializing provider plugins...
- Finding latest version of hashicorp/google...
- Installing hashicorp/google v5.29.1...
- Installed hashicorp/google v5.29.1 (signed by HashiCorp)

Terraform has created a lock file .terraform.lock.hcl to record the provider
selections it made above. Include this file in your version control repository
so that Terraform can guarantee to make the same selections by default when
you run "terraform init" in the future.

Terraform has been successfully initialized!

You may now begin working with Terraform. Try running "terraform plan" to see
any changes that are required for your infrastructure. All Terraform commands
should now work.

If you ever set or change modules or backend configuration for Terraform,
rerun this command to reinitialize your working directory. If you forget, other
commands will detect it and remind you to do so if necessary.
student_00_d3f3d85fa4728@cloudshell:~ (qwiklabs-gcp-01-0824af387e69) $
```

- Créer l'infrastructure

```
terminal
(qwiklabs-gcp-01-0824af387e69) x +
Open Editor

+ initialize_params (
+   image           = "debian-cloud/debian-11"
+   labels           = (known after apply)
+   provisioned_l0pa = (known after apply)
+   provisioned_throughput = (known after apply)
+   size            = (known after apply)
+   type            = (known after apply)
+ )
+
+ network_interface {
+   internal_ipv6_prefix_length = (known after apply)
+   ipv6_access_type            = (known after apply)
+   ipv6_address                = (known after apply)
+   name                        = (known after apply)
+   network                     = "default"
+   network_ip                  = (known after apply)
+   stack_type                  = (known after apply)
+   subnet                      = (known after apply)
+   subnetwork                  = (known after apply)
+   subnetwork_project          = (known after apply)
+
+   access_config {
+     nat_ip = (known after apply)
+     network_tier = (known after apply)
+   }
+ }

Plan: 1 to add, 0 to change, 0 to destroy.

Do you want to perform these actions?
Terraform will perform the actions described above.
Only 'yes' will be accepted to approve.
Enter a value: yes

google_compute_instance.terraform: Creating...
google_compute_instance.terraform: Still creating... [10s elapsed]
google_compute_instance.terraform: Creation complete after 18s [id=projects/qwiklabs-gcp-01-0824af387e69/zones/us-west1-c/instances/terraform]

Apply complete! Resources: 1 added, 0 changed, 0 destroyed.
student_00_d3f3d85fa472@cloudshell:~ (qwiklabs-gcp-01-0824af387e69) $

terminal
(qwiklabs-gcp-01-0824af387e69) x +
Open Editor

student_00_d3f3d85fa472@cloudshell:~ (qwiklabs-gcp-01-0824af387e69) $ terraform apply
google_compute_instance.terraform: Refreshing state... [id=projects/qwiklabs-gcp-01-0824af387e69/zones/us-west1-c/instances/terraform]

Terraform used the selected providers to generate the following execution plan. Resource actions are indicated with the following symbols:
- update in-place

Terraform will perform the following actions:

# google_compute_instance.terraform will be updated in-place
- resource "google_compute_instance" "terraform" {
  id           = "projects/qwiklabs-gcp-01-0824af387e69/zones/us-west1-c/instances/terraform"
  machine_type = "e2-micro"
  name         = "terraform"
  tags         = ["dev", "web"]
}
+ (15 unchanged attributes hidden)
+ (4 unchanged blocks hidden)

Plan: 0 to add, 1 to change, 0 to destroy.

Do you want to perform these actions?
Terraform will perform the actions described above.
Only 'yes' will be accepted to approve.
Enter a value: yes

google_compute_instance.terraform: Modifying... [id=projects/qwiklabs-gcp-01-0824af387e69/zones/us-west1-c/instances/terraform]

Error: Changing the machine_type, min_cpu_platform, service_account, enable_display, shielded_instance_config, scheduling, node_affinities or network_interface.[id].(network/subnetwork/subnetwork_project) or advanced machine features on a started instance requires stopping it. To acknowledge this, please set allow_stopping_for_update = true in your config. You can also stop it by setting desired_status = "TERMINATED", but the instance will not be restarted after the update.

with google_compute_instance.terraform,
on main.tf line 16, in resource "google_compute_instance" "terraform":
16: resource "google_compute_instance" "terraform" {

student_00_d3f3d85fa472@cloudshell:~ (qwiklabs-gcp-01-0824af387e69) $
```

Infrastructure as Code avec Terraform

Terminer l'atelier

00:47:36

Attention : Une fois dans la console, respectez scrupuleusement les instructions de l'atelier. À défaut, votre compte pourrait être bloqué. En savoir plus.

Open Google Cloud console

Username

student-00-d3f3d85fa472

Password

JoI8EmSYU1PF

GCP Project ID

qwiklabs-gcp-01-0824af387e69

Vous devriez obtenir le résultat suivant (ne copiez pas cet exemple) :

```
...
Apply complete! Resources: 1 added, 0 changed, 0 destroyed.
```

Remarque : Si vous recevez un message d'erreur, revenez aux étapes précédentes pour vérifier que vous avez saisi le code approprié dans le fichier "main.tf".

Cliquez sur **Vérifier ma progression** pour confirmer que l'instance Compute Engine a bien été créée.

✓

Créer l'infrastructure

Vérifier ma progression

Assessment Completed!

Merve Erbas

merve.eras@etu.u-paris.fr

Essai de 30 jours

Paramètres

Se déconnecter

Vie privée · Conditions d'utilisation

l'infrastructure

Tâche 6 : Détruire l'infrastructure

- Modifier l'infrastructure


```
+ boot_disk {
+   auto_delete      = true
+   device_name      = (known after apply)
+   disk_encryption_key_sha256 = (known after apply)
+   kms_key_self_link = (known after apply)
+   mode             = "READ_WRITE"
+   source           = (known after apply)
+
+   initialize_params {
+     image = "debian-cloud/debian-11"
+     labels = (known after apply)
+     provisioned_iops = (known after apply)
+     provisioned_throughput = (known after apply)
+     size = (known after apply)
+     type = (known after apply)
+   }
+ }

+ network_interface {
+   internal_ipv6_prefix_length = (known after apply)
+   ipv6_access_type           = (known after apply)
+   ipv6_address               = (known after apply)
+   name                       = (known after apply)
+   network                    = "default"
+   network_ip                 = (known after apply)
+   stack_type                 = (known after apply)
+   subnetwork                 = (known after apply)
+   subnetwork_project         = (known after apply)
+
+   access_config {
+     nat_ip = (known after apply)
+     network_tier = (known after apply)
+   }
+ }

Plan: 1 to add, 0 to change, 0 to destroy.

Note: You didn't use the -out option to save this plan, so Terraform can't guarantee it will take exactly these actions if you run "terraform apply" now.
student_00_d3f3d85fa472@cloudshell:~ (qwiklabs-gcp-01-0824af387e69)$
```

← Infrastructure as Code avec Terraform

Terminer l'atelier 00:41:30

Attention : Une fois dans la console, respectez scrupuleusement les instructions de l'atelier. À défaut, votre compte pourrait être bloqué. [En savoir plus.](#)

[Open Google Cloud console](#)

Username
student-00-d3f3d85fa472

Password
JoI8EmSYU1PF

GCP Project ID
qwiklabs-gcp-01-0824af387e69

```
# (4 unchanged blocks hidden)
}

Plan: 0 to add, 1 to change, 0 to destroy.
```

Le préfixe ~ signifie que Terraform va mettre à jour la ressource sur place.

4. Répondez yes lorsque vous y êtes invité. Terraform ajoute alors les tags à votre instance.

Cliquez sur [Vérifier ma progression](#) pour confirmer que les tags ont bien été ajoutés.

Ajouter des tags à la ressource de calcul

✓

Vérifier ma progression

Assessment Completed!

Merve Erbas
merve.eras@etu.u-paris.fr

[Essai de 30 jours](#)

[Paramètres](#)

[Se déconnecter](#)

Vie privée · Conditions d'utilisation

- Changer le type de machine sans arrêter la VM


```
CLOUD SHELL
Terminal (qwiklabs-gcp-01-0824af387e69) x +
Open Editor

Plan: 0 to add, 1 to change, 0 to destroy.

Note: You didn't use the -out option to save this plan, so Terraform can't guarantee it takes exactly these actions if you run "terraform
apply" now.
student_00_d3f3d85fa472@cloudshell:~ (qwiklabs-gcp-01-0824af387e69) $ terraform apply
google_compute_instance.terraform: Refreshing state... [id=projects/qwiklabs-gcp-01-0824af387e69/zones/us-west1-c/instances/terraform]

Terraform used the selected providers to generate the following execution plan. Resource actions are indicated with the following symbols:
  ~ update in-place
  + create new resource
  - destroy resource

Terraform will perform the following actions:

# google_compute_instance.terraform will be updated in-place
resource "google_compute_instance" "terraform" {
  id         = "projects/qwiklabs-gcp-01-0824af387e69/zones/us-west1-c/instances/terraform"
  name       = "terraform"
  tags       = ["dev", "web"]
  # (13 unchanged attributes hidden)
  # (4 unchanged blocks hidden)
}

Plan: 0 to add, 1 to change, 0 to destroy.

Do you want to perform these actions?
Terraform will perform the actions described above.
Only 'yes' will be accepted to approve.

Enter a value: yes


google_compute_instance.terraform: Modifying... [id=projects/qwiklabs-gcp-01-0824af387e69/zones/us-west1-c/instances/terraform]
google_compute_instance.terraform: Still modifying... [id=projects/qwiklabs-gcp-01-0824af387e69/zones/us-west1-c/instances/terraform, 10s elapsed]
google_compute_instance.terraform: Modifications complete after 11s [id=projects/qwiklabs-gcp-01-0824af387e69/zones/us-west1-c/instances/terraform]

Apply complete! Resources: 0 added, 1 changed, 0 destroyed.
student_00_d3f3d85fa472@cloudshell:~ (qwiklabs-gcp-01-0824af387e69) $
```

- Vérifier le résultat dans la console Cloud

Google Cloud console interface showing VM instances. The left sidebar lists navigation options like 'Virtual machines', 'Instance templates', 'Sole-tenant nodes', 'Machine images', 'TPUs', 'Committed use discounts', 'Reservations', and 'Storage'. The main panel displays 'VM instances' with a table showing one instance named 'terraform' in the 'us-west1-c' zone. Below the table, there are 'Related actions' such as 'Explore Backup and DR', 'Monitor VMs', 'Explore VM logs', 'Set up firewall rules', 'Patch management', and 'Load balance between VMs'. On the right, a sidebar titled 'Get started with Compute Engine' offers various tutorials.

-Modifier infracture








CLOUD SHELL

Terminal

(qwiklabs-gcp-01-0824af387e69) X +

Open Editor



```
student_00_d3f3d85fa728@cloudshell:~ (qwiklabs-gcp-01-0824af387e69) $ terraform apply
google_compute_instance.terraform: Refreshing state... [id-projects/qwiklabs-gcp-01-0824af387e69/zones/us-west1-c/instances/terraform]

Terraform used the selected providers to generate the following execution plan. Resource actions are indicated with the following symbols:
- update in-place

Terraform will perform the following actions:

# google_compute_instance.terraform will be updated in-place
- resource "google_compute_instance" "terraform" {
  id           = "projects/qwiklabs-gcp-01-0824af387e69/zones/us-west1-c/instances/terraform"
  machine_type = "e2-micro" -> "e2-medium"
  name        = "terraform"
  tags       = ["dev", "web"]
}
# (18 unchanged attributes hidden)
# (4 unchanged blocks hidden)

Plan: 0 to add, 1 to change, 0 to destroy.

Do you want to perform these actions?
Terraform will perform the actions described above.
Only 'yes' will be accepted to approve.


Enter a value: yes

google_compute_instance.terraform: Modifying... [id-projects/qwiklabs-gcp-01-0824af387e69/zones/us-west1-c/instances/terraform]

Error: Changing the machine type, min cpu platform, service account, enable display, shielded instance config, scheduling.node affinities or network interface.[8d].(network/subnetwork/subnetwork_project) or advanced machine features on a started instance requires stopping it. To acknowledge this, please set allow_stopping_for_update = true in your config. You can also stop it by setting desired_status = "TERMINATED", but the instance will not be restarted after the update.

with google_compute_instance.terraform,
on main.tf line 16, in resource "google_compute_instance" "terraform":
16: resource "google_compute_instance" "terraform" {}

student_00_d3f3d85fa728@cloudshell:~ (qwiklabs-gcp-01-0824af387e69) $
```








CLOUD SHELL

Terminal

(qwiklabs-gcp-01-0824af387e69) X +

Open Editor



```
Plan: 0 to add, 1 to change, 0 to destroy.

Note: You didn't use the -out option to save this plan, so Terraform can't guarantee to take exactly these actions if you run "terraform apply" now.
student_00_d3f3d85fa728@cloudshell:~ (qwiklabs-gcp-01-0824af387e69) $ terraform apply
google_compute_instance.terraform: Refreshing state... [id-projects/qwiklabs-gcp-01-0824af387e69/zones/us-west1-c/instances/terraform]

Terraform used the selected providers to generate the following execution plan. Resource actions are indicated with the following symbols:
- update in-place

Terraform will perform the following actions:

# google_compute_instance.terraform will be updated in-place
- resource "google_compute_instance" "terraform" {
  id           = "projects/qwiklabs-gcp-01-0824af387e69/zones/us-west1-c/instances/terraform"
  name        = "terraform"
  tags       = ["dev", "web"]
}
# (19 unchanged attributes hidden)
# (4 unchanged blocks hidden)

Plan: 0 to add, 1 to change, 0 to destroy.

Do you want to perform these actions?
Terraform will perform the actions described above.
Only 'yes' will be accepted to approve.

Enter a value: yes

google_compute_instance.terraform: Modifying... [id-projects/qwiklabs-gcp-01-0824af387e69/zones/us-west1-c/instances/terraform]
google_compute_instance.terraform: Still modifying... [id-projects/qwiklabs-gcp-01-0824af387e69/zones/us-west1-c/instances/terraform, 10s elapsed]
google_compute_instance.terraform: Modifications complete after 11s [id-projects/qwiklabs-gcp-01-0824af387e69/zones/us-west1-c/instances/terraform]

Apply complete! Resources: 0 added, 1 changed, 0 destroyed.
student_00_d3f3d85fa728@cloudshell:~ (qwiklabs-gcp-01-0824af387e69) $
```

VM instances

Connecting to instances

Tutorial

Learn basic ways to connect to your Compute Engine instances.

Connecting to instances using advanced methods

Help document

This document describes how to connect to Linux virtual machine (VM) instances that have external IP addresses.

Transferring files to Linux VMs

Tutorial

5 min

Learn how to transfer files to or from a Linux VM.

Managing SSH keys in metadata

Help document

Learn how to share or restrict user or application access to your VMs.

Assigning an external IP address to an existing instance

Help document

Learn how to change or assign an external IP address, either ephemeral or static, to an existing instance by modifying the instance's access configuration.

Connecting to instances

Tutorial

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18

← Infrastructure as Code avec Terraform

340 pts

18th

Terminer l'atelier

00:41:30

Attention : Une fois dans la console, respectez scrupuleusement les instructions de l'atelier. À défaut, votre compte pourrait être bloqué. En savoir plus.

Open Google Cloud console

Username

student-00-d3f3d85fa47;

Password

JoI8EmSYU1PF

GCP Project ID

qwiklabs-gcp-01-0824af

(4 unchanged blocks hidden)

Plan: 0 to add, 1 to change, 0 to destroy.

Le préfixe ~ signifie que Terraform va mettre à jour la ressource sur place.

4. Répondez **yes** lorsque vous y êtes invité. Terraform ajoute alors les tags à votre instance.

Cliquez sur *Vérifier ma progression* pour confirmer que les tags ont bien été ajoutés.

Ajouter des tags à la ressource de calcul

Vérifier ma progression

Assessment Completed!

Merve Erbas

merve.eras@etu.u-paris.fr

Essai de 30 jours

Paramètres

Se déconnecter

Vie privée · Conditions d'utilisation

- Changer le type de machine sans arrêter la VM

CLOUD SHELL Terminal (qwiklabs-gcp-01-0824af387e69)

Open Editor

```
# google_compute_instance.terraform will be updated in-place
- resource "google_compute_instance" "terraform" {
  + allow_stopping_for_update = true
  id                         = "projects/qwiklabs-gcp-01-0824af387e69/zones/us-west1-c/instances/terraform"
  - machine_type              = "e2-micro" -> "e2-medium"
  name                       = "terraform"
  tags                       = [
    "dev",
    "web",
  ]
}
# (18 unchanged attributes hidden)
# (4 unchanged blocks hidden)

Plan: 0 to add, 1 to change, 0 to destroy.

Do you want to perform these actions?
  Terraform will perform the actions described above.
  Only 'yes' will be accepted to approve.

Enter a value: yes

google_compute_instance.terraform: Modifying... [id-projects/qwiklabs-gcp-01-0824af387e69/zones/us-west1-c/instances/terraform]
google_compute_instance.terraform: Still modifying... [id-projects/qwiklabs-gcp-01-0824af387e69/zones/us-west1-c/instances/terraform, 10s elapsed]
google_compute_instance.terraform: Still modifying... [id-projects/qwiklabs-gcp-01-0824af387e69/zones/us-west1-c/instances/terraform, 20s elapsed]
google_compute_instance.terraform: Still modifying... [id-projects/qwiklabs-gcp-01-0824af387e69/zones/us-west1-c/instances/terraform, 30s elapsed]
google_compute_instance.terraform: Still modifying... [id-projects/qwiklabs-gcp-01-0824af387e69/zones/us-west1-c/instances/terraform, 40s elapsed]
google_compute_instance.terraform: Still modifying... [id-projects/qwiklabs-gcp-01-0824af387e69/zones/us-west1-c/instances/terraform, 50s elapsed]
google_compute_instance.terraform: Still modifying... [id-projects/qwiklabs-gcp-01-0824af387e69/zones/us-west1-c/instances/terraform, 1m0s elapsed]
google_compute_instance.terraform: Still modifying... [id-projects/qwiklabs-gcp-01-0824af387e69/zones/us-west1-c/instances/terraform, 1m10s elapsed]
google_compute_instance.terraform: Modifications complete after 1m16s [id-projects/qwiklabs-gcp-01-0824af387e69/zones/us-west1-c/instances/terraform]

Apply complete! Resources: 0 added, 1 changed, 0 destroyed.
student_00_d3f3d85fa47@cloudshell: (qwiklabs-gcp-01-0824af387e69) $
```

VM instances

Connecting to instances

Tutorial

Learn basic ways to connect to your Compute Engine instances.

Connecting to instances using advanced methods

Help document

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5 min

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Help document

Learn how to change or assign an external IP address, either ephemeral or static, to an existing instance by modifying the instance's access configuration.

Firewalls

HTTP traffic	Off
HTTPS traffic	Off
Allow Load Balancer Health checks	Off

Network tags

dev web

Network interfaces

Name ↑	Network	Subnetwork	Primary internal IP address	Alias IP ranges	IP stack type
nic0	default	default	10.138.0.2		IPv4

← Infrastructure as Code avec Terraform

🔗 ❤️ ? 🌐 ⭐ 350 pts 🏆 18th 👤

Terminer l'atelier 00:34:21

Attention : Une fois dans la console, respectez scrupuleusement les instructions de l'atelier. À défaut, votre compte pourrait être bloqué. En savoir plus.

[Open Google Cloud console](#)

Username

student-00-d3f3d85fa47;

Password

JoI8EmSYU1PF

GCP Project ID

qwiklabs-gcp-01-0824af;

dev web

Network interfaces

Name ↑	Network	Subnetwork
nic0	default	default

Cliquez sur **Vérifier ma progression** pour confirmer que le type de machine Compute Engine fourni par Terraform est bien "e2-medium".



Changer le type de machine de l'infrastructure

[Vérifier ma progression](#)

Assessment Completed!



Merve Erbas
merve.eras@etu.u-paris.fr

[Essai de 30 jours](#)

[Paramètres](#)

[Se déconnecter](#)

Vie privée · Conditions d'utilisation

l'infrastructure

Tâche 6 : Détruire

Machine configuration

Machine type	e2-medium
CPU platform	Intel Broadwell
Minimum CPU platform	None
Architecture	x86_64
vCPUs to core ratio ?	—
Custom visible cores ?	—
Display device	Disabled Enable to use screen capturing and recording tools
GPUs	None
Resource policies	

Networking

Public DNS PTR Record	None
Total egress bandwidth tier	—
NIC type	—

[VIEW IN NETWORK TOPOLOGY](#)

- Détruire l'infrastructure

```
- automatic_restart = true -> null
- min_node_cpus     = 0 -> null
- on_host_maintenance = "MIGRATE" -> null
- preemptible       = false -> null
- provisioning_model = "STANDARD" -> null
}

- shielded_instance_config {
-   enable_integrity_monitoring = true -> null
-   enable_secure_boot         = false -> null
-   enable_vtpm                = true -> null
}
}
```

Plan: 0 to add, 0 to change, 1 to destroy.

Do you really want to destroy all resources?
Terraform will destroy all your managed infrastructure, as shown above.
There is no undo. Only 'yes' will be accepted to confirm.

Enter a value: yes

google_compute_instance.terraform: Destroying... [id=projects/qwiklabs-gcp-01-0824af387e69/zones/us-west1-c/instances/terraform]
google_compute_instance.terraform: Still destroying... [id=projects/qwiklabs-gcp-01-0824af387e69/zones/us-west1-c/instances/terraform, 10s elapsed]
google_compute_instance.terraform: Still destroying... [id=projects/qwiklabs-gcp-01-0824af387e69/zones/us-west1-c/instances/terraform, 20s elapsed]
google_compute_instance.terraform: Still destroying... [id=projects/qwiklabs-gcp-01-0824af387e69/zones/us-west1-c/instances/terraform, 30s elapsed]
google_compute_instance.terraform: Still destroying... [id=projects/qwiklabs-gcp-01-0824af387e69/zones/us-west1-c/instances/terraform, 40s elapsed]
google_compute_instance.terraform: Still destroying... [id=projects/qwiklabs-gcp-01-0824af387e69/zones/us-west1-c/instances/terraform, 50s elapsed]
google_compute_instance.terraform: Destruction complete after 53s

Destroy complete! Resources: 1 destroyed.

student_00_d3f3d85fa472@cloudshell:~ (qwiklabs-gcp-01-0824af387e69) \$

← Infrastructure as Code avec Terraform

comment détruire complètement votre infrastructure gérée par Terraform.

Terminer l'atelier 00:32:15

Attention : Une fois dans la console, respectez scrupuleusement les instructions de l'atelier. À défaut, votre compte pourrait être bloqué. En savoir plus.

[Open Google Cloud console](#)

Username
student-00-d3f3d85fa47:

Password
JoI8EmSYU1PF

GCP Project ID
qwiklabs-gcp-01-0824af:

1. Exécutez la commande ci-dessous. Répondez **yes** pour exécuter ce plan et détruire l'infrastructure :

```
terraform destroy
```

Le préfixe `-` indique que l'instance et le réseau vont être détruits.

2. Vérifiez que l'instance Terraform n'existe plus en accédant à **Instances de VM** dans la console Cloud.

Cliquez sur *Vérifier ma progression* pour confirmer que l'infrastructure a bien été détruite.

Détruire l'infrastructure

Vérifier ma progression

Assessment Completed!

Merve Erbas
merve.eras@etu.u-paris.fr
Essai de 30 jours

[Paramètres](#)

[Se déconnecter](#)

Vie privée · Conditions d'utilisation

l'infrastructure

Tâche 6 : Détruire l'infrastructure

4. Conclusion

Ces ateliers ont permis de comprendre les principes de base de Google Cloud Platform, de déployer des applications, d'utiliser des services spécifiques de GCP, de configurer et sécuriser les services cloud, et d'analyser des données en utilisant les outils de Google Cloud. Les compétences acquises sont essentielles pour le développement, la gestion et la mise à l'échelle des applications cloud modernes.

Pour plus de détails et pour consulter les sorties des commandes et les captures d'écran, veuillez visiter mon GitHub :

https://github.com/merbass/master_VMI